

Ayahuasca, Psychedelic Studies and Health Sciences: The Politics of Knowledge and Inquiry into an Amazonian Plant Brew

Kenneth W. Tupper^{*,1} and Beatriz C. Labate²

¹*School of Population and Public Health, University of British Columbia, BC, Canada*

²*Center for Research and Post Graduate Studies in Social Anthropology (CIESAS), Guadalajara, and Center for Economic Research and Education (CIDE), Aguascalientes, Mexico*



Abstract: This article offers critical sociological and philosophical reflections on ayahuasca and other psychedelics as objects of research in medicine, health and human sciences. It situates 21st century scientific inquiry on ayahuasca in the broader context of how early modern European social trends and intellectual pursuits translated into new forms of empiricism and experimental philosophy, but later evolved into a form of dogmatism that inconvenienced the political suppression of academic inquiry into psychedelics. Applying ideas from the field of science and technology studies, we consider how ayahuasca's myriad ontological



representations in the 21st century — for example, plant teacher, traditional medicine, religious sacrament, material commodity, cognitive tool, illicit drug — influence our understanding of it as an object of inquiry. We then explore epistemological issues related to ayahuasca studies, including how the indigenous and mestizo concept of “plant teacher” or the more instrumental notion of psychedelics as “cognitive tools” may impact understanding of knowledge. This leads to questions about whether scientists engaged in ayahuasca research should be expected to have personal experiences with the brew, and how these may be perceived to help or hinder the objectivity of their pursuits. We conclude with some brief reflections on the politics of psychedelic research and impediments to academic knowledge production in the field of psychedelic studies.

Keywords: Ayahuasca, cognitive tool, epistemology, ontology, psychedelic, science and technology studies, self-experimentation.

INTRODUCTION

Ayahuasca has become an object of growing popular and scientific interest around the world in the past few decades. Prior to the 1990s, ayahuasca was a relatively obscure cultural artifact in the global North, known mostly to anthropologists, travelers or aficionados of psychoactive plants. However, with the rise of reliable and affordable air travel to the Amazon and the information revolution of the internet, as well as increasing interest in alternative healing practices and the expansion and diversification of the New Age movement, the last twenty years have been a period of what has been characterized as the globalization or internationalization of ayahuasca [1-3]. Spiritual seeking has been a significant part of this trend, as illustrated by the transnational growth of Brazilian ayahuasca religions, the Santo Daime and União do Vegetal (or UDV), as well as spiritually-oriented hybrid or “neo-shamanic” practices drawing on mestizo Amazonian folk traditions [4, 5]. Among the key reasons people give for their interest in drinking ayahuasca in these various settings is its purported health benefits [5, 6], including helping to overcome addictions to

alcohol, other drugs, or other harmful or self-destructive behaviours [7]. This has led to an increase both in people seeking opportunities to experience the brew, and in researchers who wish to conduct scientific studies for its physical, psychological and public health impacts.

The scientific study of ayahuasca and its effects on health is a comparatively new yet steadily burgeoning field of inquiry. Once limited to a few sub-disciplines of botany, pharmacology and anthropology, ayahuasca research now extends into many corridors of the academy, including the natural sciences, social sciences, and humanities [8]. Medical researchers in particular are increasingly showing interest in conducting scientific studies on ayahuasca. As McKenna, Callaway and Grob put it in the late 1990s, “the focus for the scientific study and understanding of ayahuasca has shifted from the ethnographer's field notes and the ethnobotanist's herbarium specimens, to the neurophysiologist's laboratory and the psychiatrist's examining room” [9, 73]. Studies conducted on ayahuasca over the last few decades have included work in the fields of human pharmacokinetics, psychopharmacology, neuropsychology, transcultural psychiatry and addiction medicine. Specific illnesses or ailments for which ayahuasca is being investigated as a potentially valuable therapeutic intervention include substance dependence, depression, anxiety, post-traumatic stress disorder, eating disorders, identity issues, and overall

*Address correspondence to this author at the School of Population and Public Health, University of British Columbia, BC, Canada;
Tel: 604-822-2772; Fax: 604-822-4994; E-mail: ktupper@telus.net

improvement to quality of life [7]. These trends illustrate a notable contribution to the renaissance of psychedelic science more generally, also exemplified by well-attended thematic tracks devoted to ayahuasca at several international scientific conferences [10], and a steady growth of publications about ayahuasca in established medical and health science journals. Yet, as we will argue, in the process of this increasing academic and scientific interest in ayahuasca, researchers are being challenged not just by the complex interactions of the brew, its ritual uses and its effects on drinkers, but also by how their object of study may confound some conventional assumptions in biomedicine and even science itself.

This article undertakes a brief historical, sociological and philosophical analysis of ayahuasca as an object of scientific research, particularly as it is a topic of interest in medicine and public health. It frames ayahuasca research within the broader fields of science and technology studies (STS) and the sociology of knowledge, to consider how the pursuit of scientific understanding of the brew provokes questions, raises issues and challenges assumptions about long-enduring ideas in the history and philosophy of science. Some of the STS themes we explore have also emerged in recent sociological studies of early 21st century psychedelic laboratory practices and research frames [11, 12]. Our analysis begins with consideration of ontological questions about ayahuasca, or what “ayahuasca” is, as a thing in the world, and how it is categorized as an object of inquiry for modern science. We next take up epistemology with respect to ayahuasca and psychedelics more generally, and how the traditional indigenous concept of “plant teacher,” or alternatively, an instrumental “cognitive tool” frame for these kinds of substances, may have heuristic value for broadening conceptions of knowledge. This leads us to questions of scientific empiricism and disciplinary demands for objectivity, which reveal tensions with respect to expectations that scientists engaged in ayahuasca or other psychedelic research should (or should not) have personal experiences with the “objects” of their research. Finally, we conclude by briefly considering some of the political challenges of ayahuasca research, and the ramifications of why and how ayahuasca is being scientifically objectified in the early 21st century.

HISTORY OF SCIENCE AND PHILOSOPHY

To contextualize our discussion about the scientific study of ayahuasca and psychedelics, a brief digression on the history of science and its relation to philosophy is in order. The word “science” derives etymologically from the Latin *scientia*, meaning “knowledge,” and retained a broader epistemological significance until well into the Enlightenment. During its nascency in the 16th and 17th centuries, early modern science was the enterprise of what were then known as natural philosophers, amateur intellectuals who were driven to seek or establish methodological and empirical foundations for certain knowledge. The European worldview at that time was being shaken by post-Copernican uncertainties about the Ptolemaic firmament, post-Columbian doubts about geographic and other knowledge of the Ancients, and post-Lutheran questionings about authoritative religious dogmas [13]. At

the same time, material or economic forces and conceptual tools — including ideas and devices such as clockworks, Arabic numerals, double-entry bookkeeping, and probability theory — were engendering an epistemic turn towards mechanization, quantification, statistics, and the pursuit of objective “facts” [14, 15]. And the gradual dispersion of the printing press and the consequent exponential proliferation of texts evolved into new media for knowledge transfer, accelerating how people could both shape and be shaped by these trends.

By the 19th century, the primary meaning of “science” became increasingly restricted to its current predominant sense of the systematized and professionalized study of physical and human nature. This meaning of science consolidated experimentation, empirical observation, quantification and statistical analysis as essential methodological foundations for modern epistemic pursuits, and was bound up with political liberalism as a form of governmentality and capitalism as an economic system [16]. At this time, the deployment of the technological fruits of scientific knowledge for political purposes—the original impetus for Francis Bacon’s call to adopt a systematized approach to understanding nature—was further advanced by evolving entities such as joint-stock companies and liberal nation states. In the 20th century, science became synonymous with material technology in the mainstream public discourses of late modernity [17], which translated into greater military and industrial power for governments, increasingly appealing products, services and entertainments for consumers, and rising profits for corporate shareholders. As a result, some of the deep philosophical questions that spawned early scientific thinking seem to have become less immediately relevant today, including for the quotidian practices of many scientists themselves.

While early scientists challenged dogmatism and authority as a matter of principle, critics today argue that science has moved away from its revolutionary philosophical roots and in some ways manifested as an ideological belief system in its own right, known as “scientism” [18]. Predicated on values of materialism, reductionism and technical rationality, scientism positioned the increasingly restricted modern meaning of “science” as the only legitimate way of knowing. Ultimately, scientism evolved into a belief system whereby the ideological imperatives of objectivity, measurement and quantification were demanded of almost *all* forms of human knowledge, at least those for which states or corporations are inclined to provide political and economic support to pursue. This amounts to a stance on epistemic legitimacy and authority no less dogmatic than the religious convictions from which early scientists had originally sought to distance themselves. Yet it is important to recognize that the hegemonic epistemological status of scientific research nowadays is, as sociologist Immanuel Wallerstein argues, in part,

the result of the so-called divorce between science and philosophy [in 19th century university faculties], and the reification of modern science as a separate method, a different theory of knowledge from philosophy, the only route (according to the scientists) to truth. Science, as it was now

being defined, was more than merely another form of knowledge. It was the anti-philosophy, because philosophy was speculation and hence had no claims to be truth [19, pp. 66-7].

Philosophers in the academy were relegated to humanities departments in faculties of arts, while science faculties grew in power and prestige and established epistemic norms to which others aspired. Yet, the trends in late modern science—where institutionalized professional concerns are largely about seeking grants, securing patents, publishing papers, and otherwise successfully competing for recognition and funding in a politicized and revenue-focused corporate academic environment—mean that philosophical reflection on the nature of knowledge and the cosmos are seldom incentivized as a priority for today's professional scientists [20]. Researchers may harbour the inclination, but few have the time or the professional or economic incentives to give more than cursory attention to the deep philosophical roots underlying what is pursued in the name of scientific inquiry. The implications of these trends for contemporary psychedelic studies will be considered towards the end of our discussion, but for now we will turn to some of the primary philosophical questions the scientific study of ayahuasca raises.

SCIENCE AND THE ONTOLOGY OF AYAHUASCA

Ontology, as it bears on the scientific project generally, has been a topic of considerable interest in the STS field in recent years [21, 22], so ontological questions as they relate to ayahuasca research are a fitting preliminary consideration. Again, one of the foremost aspects of the natural philosophy in which modern scientific knowledge production is historically rooted was a sub-branch of metaphysics, ontology—asking questions about the existence and categorization of reality, querying what exists and how it should be classified. These questions are not sophistic or immaterial to our concerns, as ayahuasca can be many things to many people. For example, the traditional Amazonian indigenous and mestizo conception of ayahuasca is that it—like many other flora of the rainforest—is a “planta maestra,” or plant teacher [23]. By this understanding, ayahuasca is a living spiritual entity that can interact with humans and other forest beings through consciousness, intentionality, subjectivity and agency of its own. However, through various intermediations with socio-political forces over the past few centuries, ayahuasca has come to occupy many other ontological roles: traditional medicine, religious sacrament, nefarious potion, profitable commodity, chemical compound, illicit drug, or combinations of these and more. Thus, the ontological status of ayahuasca is inherently unstable and in flux, an amalgam of multiple competing social constructions that variously impinge on what theoretical questions or empirical approaches are used to generate knowledge about it and its effects.

It must be noted that the word “ayahuasca” itself is ontologically ambiguous, and the history of 20th century Amazonian ethnobotany illustrates the challenges that scientists had in grappling with the complexities of what exactly “ayahuasca” was [24]. Its Quechua etymological roots—roughly, *aya* means “spirit,” and *huasca* means “vine”—technically denote a species of jungle liana,

Banisteriopsis caapi, which contains several monoamine oxidase inhibitor harmala alkaloids [25]. However, in Quechua, Spanish, and now English, Portuguese and many other languages, the word “ayahuasca” also refers to a brew prepared from *B. caapi*, the production and consumption of which has been distilled through successive forces of colonialism, ecumenism, modernity and transnational expansion. While some “ayahuasca” brews have long been prepared from *B. caapi* alone, they have more typically included any of a wide range of psychoactive admixture plants, such as *Nicotiana rustica* (Amazonian tobacco), *Ilex guayusa* (a caffeine-containing leaf), *Brugmansia suaveolens* (or Angel's trumpet, containing tropane alkaloids), *Diplopterys cabrerana* (a vine containing N,N-dimethyltryptamine and 5-methoxy-N,N-dimethyltryptamine), and *Psychotria viridis* (a leaf containing N,N-dimethyltryptamine, or DMT) [26, 27].

Currently, the extended meaning of “ayahuasca” in global public discourses is somewhat ontologically stabilized as a brew composed exclusively of *B. caapi*, *P. viridis* and water. The sacraments of the international Brazilian churches, daime (Santo Daime) and hoasca tea (UDV), have helped fix the meaning of “ayahuasca” to this simple recipe. The UDV's traditions at one time allowed for the use of admixture plants with its hoasca sacrament, but for strategic reasons associated with securing political legitimacy for its religious practices, it ultimately institutionalized the more standardized “pure” brew of *B. caapi* and *P. viridis* [28]. However, outside these church settings, a wide range of preparations may be dispensed as “ayahuasca” in contemporary indigenous, mestizo, or hybridized ceremonies, sometimes unwittingly and sometimes knowingly [29]. On the other hand, yagé, which is usually made of *B. caapi* and *D. cabrerana* in Colombia [25], or *natem*, which is made with *B. caapi* but not necessarily *P. viridis* in Ecuador, are frequently represented homogeneously as “ayahuasca” [30]. Thus, people reporting on their use of “ayahuasca” consumed in settings other than the Brazilian ayahuasca churches may have encountered a diverse range of brews and assorted admixture constituents. All this is not to say that such experiences are in any way inauthentic (however that may be construed), but rather that the homogenization typically desired for scientific research purposes may not easily be found in the diversity of empirical settings for ayahuasca drinking. Thus, as an object of scientific research, “ayahuasca” requires careful sourcing for experimental, clinical or laboratory uses, analysis of chemical constituents, and in some cases alternative formulations that stretch ontological classificatory boundaries. In fact, some medical researchers have found that the brews prepared for contemporary religious uses, rather than those used in folk healing contexts, are most standardized in terms of constituent ingredients and thus desirable for scientific research purposes [31].

The challenges resulting from the cultural diversity and variability of ayahuasca recipes means that scientists investigating it began altering the object of inquiry itself. In scientific discourses, the term “ayahuasca” now also extends ontologically to lyophilized, or freeze-dried, powders made from the brew and put into gelatin capsules to be given to research subjects in clinical laboratories. Researchers cite their ability to standardize and control the dosage of the

constituent alkaloids in preparations of the *B. caapi* vine and the *P. viridis* leaf as being helpful, if not essential, for conducting accurate, measurable and replicable scientific experiments [32]. However, the invention of such a lyophilized preparation for the purposes of research raises questions about how experimental science has evolved from simply observing objects or artifacts to actually creating new kinds of things as a function of methodological imperatives. So whether lyophilized capsules in fact warrant the ontological status or label of “ayahuasca” is not immediately obvious and leaves open the question of whether findings of research conducted on selected subjects taking them in specific laboratory or clinical settings can be generalized to the effects of liquid preparations used in other social and ceremonial settings. Certainly ingesting numerous tasteless gelatin capsules rather than the beverage form of “ayahuasca” does not provide identical olfactory, gustatory, and immediate digestive sensations to those typically encountered when drinking the brew, and this may have some effect on the subsequent physical or psychological health outcomes. Also, in many ayahuasca traditions, water is a fundamental component considered to have spiritual relevance as part of the brew; further, according to these views, the essence of ayahuasca is related to secrets in cooking it and the ability to communicate with the spirit of the plant—elements that may not be preserved in the lyophilized capsule. In an analogous context, it is interesting to note that chemist Albert Hofmann, who first synthesized psilocybin and provided samples to Mazatec curandera Maria Sabina, reported her verdict after her first ceremonial use of them was “that the [psilocybin] pills had the same power as the mushrooms, that there was no difference” [33, p. 152]. Even if this claim has been later disputed by others, the similarities or differences between plant substances and their primary psychoactive chemical components should not be taken for granted: more empirical research on this matter is warranted.

AYAHUASCA AS A “MEDICINE”

The fact that ayahuasca has become an object of contemporary medical research, yielding promising findings of therapeutic potential in various health domains [7], suggests that the brew has the potential for the ontological status of a medicine. Certainly, ayahuasca has been deemed a “medicine” useful for healing in some Amazonian indigenous and mestizo contexts [34–36]. Yet this phenomenon—*i.e.*, the fact that the ayahuasca spirits are called *doctorcitos* and that *vegetalistas* (*i.e.*, ceremony leaders) are called also “traditional doctors” or “healers”—is due to evolving interfaces with occidental medical conceptions and is part of the process of translation of ayahuasca to a more biomedical idiom [4]. Further, as mentioned above, ayahuasca’s broader uptake globally is predicated to some degree by its alleged medicinal properties or healing effects [3, 5]. However, the concept of “medicine” is a social construction that depends on the cultural and discursive structures within which it operates. For example, what is considered a medicine in rural Latin American folk healing, Coast Salish First Nations traditional healing, traditional Chinese herbalism, or modern Western biomedical practices are all quite different. For a substance

to achieve the authorized ontological status of medicine in modern scientific and public policy discourses, it must meet exacting criteria, and this is done through processes that reflect the economic and political imperatives of the biomedical establishment—or, to be more explicit, the interests of physicians, the pharmaceutical industry, health insurance corporations, and government regulatory bureaucracies, among others [37].

With respect to its potential classificatory acceptance as a “medicine,” one of the primary challenges that the ayahuasca brew presents to the modern scientific and legal establishments is that it confounds the simplistic pharmacological reductionism that some authorities would impose on it, to cast it as essentially a preparation of “hallucinogenic” alkaloids and to attribute any discernable therapeutic effects to these constituent chemicals. Similar to objections against cannabis plant preparations being categorized as “medicine,” whereby authorities insist that only isolated pharmacological components such as tetrahydrocannabinol or cannabidiol may legitimately be classified as such [38], the dominant biomedical-legal paradigm tends to focus its explanations for research findings on the alkaloidal constituents of the ayahuasca brew [31, 39], or the equivalent of what Ott has termed “pharmahuasca” [40]. However, such purism, while perhaps deriving epistemic warrant by conforming to expected norms and standards of pharmaceutical and medical research, does so at the risk not only of changing the nature of the object under investigation, but above all of not taking into account the legitimacy of these traditions on their own terms. This strict position presumes *a priori* (rather unscientifically) that the brew’s psychoactive chemical constituents are responsible for the important aspects of its various effects, including any consequent physical or psychological healing. As a result, the reductionistic paradigm and its emphasis on molecular biochemistry becomes more deeply entrenched as the “quintessence” of the effects of ayahuasca on the human body, and the means by which these data are manufactured or constructed is only remotely explicated, and occasionally disappears completely through the scientific research process and the public dissemination of its results. The same can be said about the actual context of use, where the “scientific laboratory” is frequently — though inaccurately — represented as a non-context, or culture-free context [8, 41]. In any case, the transference of the ontological status of ayahuasca as a “medicine” in Amazonian folk healing to that of a “medicine” in modern scientific discourses is by no means straightforward and illustrates some of the complexities of its objectification through scientific research.

Finally, while ayahuasca may yet be far from achieving the ontological status of “medicine” in scientific and policy discourses, because it contains trace amounts of alkaloid constituents such as DMT, it is *ipso facto* subsumed within the superordinate ontological status of “drug,” *i.e.*, illegal psychoactive substance. For reasons that may have to do with avoiding the stigma associated with the use of more common controlled substances such as heroin, cocaine and LSD, some ayahuasca drinkers resist this classification, claiming that the brew is *not* a “drug” [3, 4, 29]. Predictably, such discursive resistance carries little truck with legal authorities, such as the International Narcotics Control Board (INCB), which in its 2010 annual report recommended that

governments “remain vigilant” about the “use and abuse” of ayahuasca [42]. The INCB’s recommended vigilance, bolstered by further advice to “consider controlling such plant material at the national level” [42, p. 47], illustrates the political commitment that some authorities have to characterizing ayahuasca as a “drug.” In so doing, they immediately invoke the logic of the international drug control regime, whereby there is an assumption of inexorable harm and need to control [43]; in practice, this means the categorical criminalization of possession and distribution of a plant or substance, even if some people are using it in *bona fide* religious or other ceremonial contexts [44]. While this is most immediately problematic for the human rights of people who drink ayahuasca, derogating from their fundamental freedoms of religion and thought [44, p. 26], the effects of such ontological commitment to casting ayahuasca as a “drug” is not insignificant for the politics of scientific research on the brew and its effects on humans, as we will discuss further below. First, however, our analysis turns to another branch of philosophy crucial to the scientific enterprise: epistemology.

EPISTEMOLOGY, AYAHUASCA AND PSYCHEDELIC STUDIES

The scientific study of ayahuasca, and more broadly other psychedelics, raises challenges in the terrain of epistemology, or the philosophical study of the nature and scope of knowledge — what it is, how it can be obtained, and under what circumstances it is realized. Epistemological questions abound in health and medical research with ayahuasca, especially in light of personal experience of the effects of the brew (an issue we address in the following section). For example, paraphrasing and expanding on what Labate and Bouso have asked in the introduction of their book *Ayahuasca y Salud* [45]: How does the set and setting of ayahuasca drinking (including ritual, music, etc.) mediate whatever healing or harming effects may result from its consumption? Is “health” something that can be objectively measured or determined, is it a subjective phenomenon or experience that varies among individuals, over time and across cultures, or is it both of these at once? How can scientists studying ayahuasca who have personal experiences with the brew reconcile their academic knowledge-generation project with the enchantment, the wonder and awe, the radical strangeness of the ayahuasca experience? How can, or should, scientific explanations for any demonstrable therapeutic effects of ayahuasca accommodate or make sense of illness etiologies attributed to spiritual causes in religious contexts, or assault sorcery through malevolent projection of magic darts in Amazonian cosmologies? How can modern science, with its paradigmatic foundations of materialism and objectivism, reconcile traditional indigenous knowledge conceptions of ayahuasca as an intentional, conscious agent—a “planta maestra”?

These latter questions may be challenging to those who feel that just to undertake research on a topic such as ayahuasca is already pushing the limits of professional respectability. Although the post-colonial impetus to accord greater scientific respect to traditional indigenous knowledge systems is gaining traction [46], to expect most scientists to

take seriously the “plant teacher” concept as an epistemic postulate would be, at least in the short run, naively optimistic. It is true that such epistemological discussions have occurred in some parts of the academy — such as in the fields of religious studies or indigenous ethnology (for example, see the discussions regarding the work of Carlos Castaneda [47], and the concept of “Amerindian perspectivism” [48])—but these are far from conventional or mainstream. Whereas native concepts such as “plant teachers” or “plants of power” are important contributions to address these non-Western epistemologies, we will look here for concepts that emerge from within the Western literary and artistic traditions that try to expand our understanding of these substances, and at the same time encourage today’s scientists to recall and emulate the epistemic open-mindedness of their early modern forebears. Accordingly, for heuristic purposes we will briefly explore a notion that already has an established foothold in the discourses of psychedelic studies: that these kinds of psychoactive substances are epistemic technologies or cognitive tools. In doing so, we do not mean to impose a new representation of ayahuasca (aiming to be the “correct” one), but rather to explicitly acknowledge that, because the brew does not neatly fit into modern scientific, legal and political categories, a process of negotiation and alternative understanding may be helpful for realizing the potential it (and other psychedelics) may have to reflexively reshape understandings of knowledge itself, as well as empirical science, personal and public health, or even planetary ecology [49].

As discussed earlier, the scientific enterprise began in the 16th and 17th centuries as a fundamentally philosophical project, for which epistemological matters were front and centre. While the impetus for questioning what knowledge is and how it can be obtained sprang from many sources in early modern natural philosophy, among the most important was the development of new kinds of instruments or tools, including clocks, theodolites, telescopes and microscopes. Such innovative mechanistic technologies of this period extended the empirical limits and quantifiable precision of human perception across time and space; but equally, they provided early modern natural philosophers with experiences that led them to question, and in many cases reject, traditional dogmatic authority about the universe and the way it works. However, the empirical evidence generated by such technologies was not immediately or universally accepted as contributing to viable or valuable knowledge. For some 17th century skeptics of the new approach to natural philosophy, it was self-evident by the norms of prevailing intellectual orthodoxy that availing oneself of such new-fangled tools as telescopes or microscopes was at best unnecessary, and at worst outright dangerous [50]. Of course, in the late 20th century a very similar reaction to claims about the epistemic utility of psychedelic substances was apparent, especially among those with no direct personal experience of their effects. Today, the advance of psychedelic research in the fields of psychology and neuroscience holds promise of regarding these substances with a new respect for not just their therapeutic potential, but also their cognitive enhancement or other non-medical possibilities.

PSYCHEDELICS AS COGNITIVE TOOLS?

The epistemic analogy between early modern mechanical instruments, such as telescopes and microscopes, and psychoactive cognitive tools has been proposed in the psychedelic studies field in application to substances other than ayahuasca. British novelist and philosopher Aldous Huxley argued that the instrumental value of psychedelic drugs might be helpful for the formal learning process, suggesting “that mescaline or some other chemical substance may play a part [in education] by making it possible for young people to ‘taste and see’ what they have learned about at second hand, or directly but at a lower level of intensity, in the writings of the religious, or the works of poets, painters and musicians” [51, p. 30]. Likewise, Alan Watts asserted that “there is no difference in principle between sharpening perception with an external instrument, such as a microscope, and sharpening it with an internal instrument, such as [psychedelic] drugs” [52, p. 20]. Timothy Leary likened the social implications of the introduction of psychedelics in the 1960s to that of the introduction of the automobile as a replacement for the horse-and-carriage at the turn of the century [53, pp. 67-8], but also argued along epistemic lines that “the metaphor that’s most accurate is the metaphor of the microscope, which brings into awareness cellular patterns that are invisible to the naked eye. In the same way, LSD brings into awareness the cellular conversations that are inaudible to the normal consciousness and for which we have no adequate symbolic language” [53, p. 137].

After considerable experience administering LSD and other psychedelics in clinical settings, psychiatrist Stanislav Grof postulated that psychedelic substances instrumentally function as a “powerful unspecific amplifier or catalyst of biochemical and neurophysiological processes in the brain” [54, p. 32]. Another veteran psychedelic researcher, William Richards, suggested that through the use of psychedelics as clinical training tools, “experiential knowledge is available of the terrain and principles of operation of the human psyche that could be of significant value for mental health professionals” [55, p. 146]. These authors all make the similar point that substances in this pharmacological class have potentially valuable instrumental utility [56]—particularly as epistemic tools “for a very particular form of human enhancement: experience of transcendence” [57, p. 320]. Although most of these technological analogies are drawn from experiences and research with psychedelic substances other than ayahuasca, such observations could be applied to the brew as well [58]. This may be especially apt in relation to the contemporary urban uses of ayahuasca— inherited, but also partly distanced, from its indigenous context—and to scientific research on its effects on humans.

For contemporary scientific research, such historical analogies between psychedelic substances and other more familiar kinds of technologies imply that interest in learning about ayahuasca and how it works may represent the cross-cultural interchange of a powerful kind of cognitive tool [59]. More importantly, it also augurs the possibility that such empirical traditions and indigenous ways of knowing could be epistemologically—and perhaps ultimately politically—innovative, and foster new kinds of intellectual and cultural creativity within Western societies. It must be

noted that the “cognitive tool” metaphor for ayahuasca (and similar kinds of substances) might be less provocative to many modern scientific researchers and scholars than the “plant teacher” concept, whose implicit animistic roots make it much more radical in epistemological terms, and therefore may push the limits of academic orthodoxy. In other words, perhaps the “cognitive tool” concept is a more immediately helpful metaphor for conceiving of these kinds of substances for research framing purposes. However, although some may appreciate and welcome the epistemic and research imagination vistas opened by a cognitive tool framing of ayahuasca, others may be threatened by, frightened of, and resistant to it. The recent history of psychedelic studies, in which human subject research was effectively suppressed for the latter third of the 20th century, is a salient example of how government, regulatory and funding authorities can react politically and intellectually against challenges to conventional ways of thinking [60].

The negative reaction to psychedelics among power elites and in popular discourse should not be surprising, as the introduction of potentially transformative cognitive tools into new cultural environments are historically associated with mixed receptions. For example, in Plato’s dialogue *Phaedrus*, Socrates recounts the myth of the Egyptian god Theuth, who extolled the value of his divine gift of writing and literacy as a cognitive tool, but was chastened for foisting on humans a technology that would make them lazy in recall, ruin their memories, and provide only an appearance of wisdom, not true wisdom [61]. Similarly, the technologies of the early modern scientific revolution were by no means universally welcomed as beneficent and a boon to humankind; some popular contemporary representations of the early modern natural philosophy—exemplified by men who had acquired the questionable “habit” of curiosity and aspired to collect wondrous reports, artifacts, instruments and gadgets—were ambivalent and unflattering [50, 62]. Even more insidious examples of fearful negative reactions to early adopters of epistemologically innovative technologies (and consequent cosmological shifts) are evident in the ecclesiastic inquisition of 16th and 17th century humanist thinkers such as Galileo Galilei, Michael Servetus and Giordano Bruno. As these previous historical examples suggest, it may be that the intensity of the scientific establishment’s suppression of psychedelic research at the end of the 20th century, beyond its specific historical determinants and context, had also to do with the magnitude of the challenge it poses to the intellectual, political and epistemic status quo. This concern may be most acutely evident in the debates among ayahuasca and other psychedelic researchers about the epistemic merits and professional risks of self-experimentation.

SELF-EXPERIMENTATION AND SCIENTIFIC KNOWLEDGE

In keeping with the medieval alchemical traditions from which they were derived, early chemical and pharmacological scientific researchers accepted self-experimentation with psychoactive substances as self-evidently and uncontroversially standard practice. Indeed, significant medical discoveries and scientific advances have been made by people whose curiosity led them to experiment

with new substances on themselves and close friends [63]. For example, nitrous oxide's psychoactive properties were first explored in the late 18th century by the young British scientist Humphrey Davy and his mentor Thomas Beddoes, an English physician who was an early proponent of health promotion and the application of science to medicine [64]. Along with a cadre of acquaintances—including poets Robert Southey and Samuel Taylor Coleridge—they engaged in rudimentary, and more than occasionally rambunctious, self-bioassays with the newly discovered gas. Davy found the experience of inhaling pure nitrous oxide exhilarating and illuminating, and also suggested it might be useful as an anaesthetic, although that insight was not realized until decades later by other experimenters in the United States [65]. Essentially, Davy pioneered the bioassay method that has been termed the “Heffter technique” [66, p. 98], a means of determining a novel substance's psychoactive properties through careful self-administration and recording of its effects. This scientific approach was named after chemist Arthur Heffter's self-experiments with mescaline at the end of the 19th century, and was later refined by independent psychedelic researchers such as Jonathan Ott [40] and Alexander and Ann Shulgin [67, 68]. These examples provide illustrative lessons on how important personal experience with pharmacological agents—a kind of psychosomatic empiricism—has been in the history of medical science.

At end of the 19th century, the American philosopher William James' self-experimentation with nitrous oxide generated experiences that he understood to be invaluable for the scientific study of consciousness and mysticism. As a result of his experiments inhaling the gas, James apprehended that “our normal waking consciousness, rational consciousness as we call it, is but one special type of consciousness, whilst all about it, parted from it by the filmiest of screens, there lie potential forms of consciousness entirely different” [69, p. 378]. However, James' interest in psychoactive substances as tools to empirically explore consciousness was in some respects anomalous, as it coincided with a broader countervailing intellectual trend towards objectivity as an epistemic virtue in science in the late 19th century [70]. The new ethic of objectivity of the period was shaped by the use of novel mechanical devices in experiment and observation, whereby the personal idiosyncrasies of the human researcher could be overcome through the mediation of external instruments and the assiduous self-effacement of the scientist. Consequently, as Nicolas Langlitz puts it, empirical methods like “self-experimentation became suspect as its results were now regarded as prone to distortion by the scientist's will” [11, p. 45]. Thus today, as Anderson notes, “although self-experimentation is often done in psychedelic research — to satisfy both the ethical goal of being able to empathize with one's research subjects and the technical goal of being able to validly interpret the resulting data — it is rarely mentioned in scientific publications for fear of the accusation of having lost one's objectivity” [12, p. 55].

Despite the political and cultural forces operating to discourage it, some psychedelic researchers not only admit to having experiences with the substances they study, but even suggest that to do so is epistemically desirable. For example, cognitive psychologist and ayahuasca researcher

Benny Shanon argues that “possessing firsthand familiarity with the ayahuasca experience is ... crucial for the academic investigator” [71, p. 264]. Similarly, Grof asserts: “I tried personally all the psychedelic substances we worked with before I gave them to others. That is the only way; there is no other possibility. One cannot learn the effect of psychedelics from reading books, no matter how sophisticated they appear to be” [72, p. 2]. Religious historian Wouter Hanegraaff likewise claims that “there can be no doubt that having personally ingested the [ayahuasca] sacrament at least once ... scholars will thereby have learned essential things about it that they would not be able to in any other way” [73, p. 98]. According to Brian Anderson, the fact that some neuroscientists have had direct contact with the brew, and are often concomitantly immersed in the narratives of ayahuasca religious communities, influences the research questions they pose [39]. For example, rather than asking: “how pathological is the ayahuasca experience?” (following the more conventional biomedical assumption of the ayahuasca-induced state of consciousness as a model for psychosis), some have instead asked “what is the nature of the ayahuasca-induced religious experience?” (which instead assumes ayahuasca as the catalyst for a mystical or spiritual state of consciousness). In a similar vein, Langlitz reports from fieldwork with some contemporary psychedelic researchers that, “even though this is rather taken as a psychopharmacological virtue than a categorical imperative, they encourage the novices to familiarize themselves with the drugs they are studying” [11, p. 50]. Recent research interviews with mental health professionals who used LSD in the former Czechoslovakia for clinical purposes indicate that they generally regarded personal experimentation for auto-gnostic, didactic, and heuristic reasons as both personally and professionally valuable [74]. With this in mind, following the reasoning that psychedelic substances are analogous to early modern scientific instruments, researchers and scientists are faced with the question of who is in a more advantageous epistemic position: the astronomer who looks through a telescope, or the one who does not?

With respect to the scientific study of ayahuasca, as mentioned above, researchers are confronted with knowledge of the traditional social construction of their object of inquiry as a “plant teacher.” This conceptualization, while derived from complex Amazonian indigenous cosmologies and traditions, has been taken up in both popular and academic discourses [59, 75], and its obvious implication is that the scientist or researcher might learn something by engaging the plant teacher first-hand through direct experience. In contrast to the radical alterity of the “plant teacher” concept, the cognitive tool frame allows for another way to conceive of how personal experience may offer epistemic insights without being as immediately challenging to the materialist and instrumentalist paradigmatic norms of modern science. In any case, both the plant teacher and cognitive tool concepts suggest that first-hand experiences of ayahuasca drinking might be desirable as an empirical epistemic foundation for academics who want to study it. However, it must also be noted that the desirability or necessity of drinking ayahuasca in order to research it would depend on the focus and topic of research, and on the wishes of the researcher. And, of course, the fact that a researcher has

drunk ayahuasca also does not in and of itself warrant quality in terms of findings, results and conclusions drawn—despite the fact that some researchers might be tempted to use this aura of “initiated” to legitimate their work.

FINAL REMARKS

The scientific study of ayahuasca is a significant part of the contemporary renaissance of psychedelic research, with investigations into the psychopharmacological effects and medical potential of the brew happening in a variety of academic fields. However, aside from questions about health benefits or harms to ayahuasca drinkers, the study of ayahuasca (and psychedelics more generally) also leads to reflections on philosophical issues that relate to the practices and products of science itself. Applying ideas from the field of STS, we have touched on some of the ontological and epistemological issues relating to ayahuasca research that seem as challenging and potentially innovative as the introduction of new instruments or cognitive tools did in the early modern scientific period. However, our discussion about ayahuasca and scientific research would not be complete without some acknowledgement of the politicized nature of modern drug and pharmacological sciences. While individual scientific investigators may aspire to objective and neutral studies of natural phenomena, the field of research into drugs in general, and psychedelics in particular, is a prominent example of how scientific knowledge (or lack thereof) is shaped by broader political and societal forces [60, 76]. The decades of quiescence in human experimentation between the late 1960s and late 1990s means that there is a significant knowledge void for psychedelic research relative to other areas of modern psychopharmacology, and an attitude among many contemporary health professionals that this line of inquiry has been “certainly discredited” and thus further scientific investigation is likely unwarranted [77, p. 176].

Recent examples of this politicization of science in relation to ayahuasca research include the “cease and desist” order the Canadian government gave to physician Gabor Maté, who was experimenting with ceremonial uses of the brew as an adjunct to addictions treatment in a First Nations community [78]. Likewise, anthropologist and ayahuasca researcher Jeremy Narby was charged criminally by Belgian “anti-sect” police authorities for allegedly inciting illicit drug use by briefly mentioning ayahuasca in an invited presentation at the University of Liege in 2012 [79], and one of the authors of this article, Beatriz Labate, has also been investigated for similar alleged transgressions by mentioning during a lecture for a course at the University of São Paulo in 2006 that she had personally enjoyed experiences of drinking ayahuasca. With respect to funding of ayahuasca and other psychedelic medical research, the perceived challenges of securing government research grants has led research collectives to use innovative approaches such as crowd-sourced funding to raise money—for example, in 2013, the Ayahuasca Treatment Outcomes Project raised almost \$30,000 in seed funding for an international addiction treatment research project [80]. Nevertheless, the philosophical and political challenges of pursuing scientific studies of ayahuasca have proven not to reduce ongoing interest in it as an object of inquiry, which for at least some

researchers has been overcome by innate human curiosity and eagerness to explore new ideas in health, wellness, and significant existential questions.

In conclusion, the pursuit of scientific knowledge about ayahuasca and other psychedelics is a function of the complex interplay among the policy and legal fields, academic research and traditional knowledge systems. As many of the chemical compounds they contain are “Schedule I” according to the 1971 Convention on Psychotropic Substances (and equivalently categorized in the national legislation of many countries), the restrictions on access even for scientific research make pursuing such knowledge so onerous that few would want to bother. However, even while difficulties exist—which also include the risks of professional stigma for investigating such unorthodox topics, manifesting as bemusement, collegial indifference or even open hostility—some researchers are motivated to persevere. This bodes well not only for exploring the therapeutic potential of substances such as ayahuasca in addiction treatment and other realms of medicine, but also for securing the human rights (e.g., freedom of religion and freedom of thought) of people whose sincere spiritual practices involve the use of the Amazonian brew. It is also worth noting that the balance of some legal cases has hinged on what kind of scientific evidence is able to be amassed with respect to the benefits or harms of regular ceremonial ayahuasca drinking [81]. For future legal and policy advances, the tensions between the pursuit of scientific knowledge and the impetus of government authorities to restrict or suppress inquiry into things they fear need to be identified and resolved. Our hope is that scientists, health professionals, policy-makers and others may dare to recognize possible limitations of current ways of knowing, to challenge orthodox scientific assumptions, and to continue the pursuit of knowledge for its own sake.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

ACKNOWLEDGEMENTS

The authors would like to thank the Stichting Open Foundation for the invitation to submit a paper for this special edition of *Current Drug Abuse Reviews*, as well as Clancy Cavnar, Andrea Langlois and Brian Anderson for helpful feedback on early drafts of this article.

REFERENCES

- [1] Tupper KW. The globalization of ayahuasca: Harm reduction or benefit maximization? *Int J Drug Policy* 2008; 19(4): 297-303.
- [2] Labate BC, Jungaberle H, editors. *The internationalization of ayahuasca*. Zürich: Lit Verlag; 2011.
- [3] Labate BC. *Ayahuasca Mamancuna merci beaucoup: Internacionalização e diversificação do vegetalismo ayahuasqueiro Peruano* [Ph.D. dissertation]. Campinas, Brazil: Universidade Estadual de Campinas; 2011.
- [4] Labate BC, Cavnar C, editors. *Ayahuasca shamanism in the Amazon and beyond*. New York: Oxford University Press; 2014.
- [5] Fotiou E. Working with “la medicina”: Elements of healing in contemporary ayahuasca rituals. *Anthropol Consciousness* 2012; 23(1): 6-27.

- [6] Winkelman M. Drug tourism or spiritual healing?: Ayahuasca seekers in Amazonia. *J Psychoactive Drugs* 2005; 37(2): 209-18.
- [7] Labate BC, Cavnar C, editors. *The therapeutic use of ayahuasca*. Berlin: Springer; 2014.
- [8] Labate BC, Rose ISd, Santos RG. *Ayahuasca religions: Comprehensive bibliography and critical essays*. Santa Cruz, CA: Multidisciplinary Association for Psychedelic Studies; 2009.
- [9] McKenna DJ, Callaway JC, Grob CS. The scientific investigation of ayahuasca: A review of past and current research. *Heffter Rev Psychedelic Res* 1998; 1: 65-77.
- [10] Labate BC, Cavnar C. The expansion of the field of research on ayahuasca: Some reflections about the ayahuasca track at the 2010 MAPS "Psychedelic Science in the 21st Century" conference. *Int J Drug Policy* 2011; 22(2): 174-8.
- [11] Langlitz N. The persistence of the subjective in neuropsychopharmacology: Observations of contemporary hallucinogen research. *History Human Sci* 2010; 23(1): 37-57.
- [12] Anderson BT. Ayahuasca as antidepressant? *Psychedelics and styles of reasoning in psychiatry. Anthropol Consciousness* 2012; 23(1): 44-59.
- [13] Shapin S. *The scientific revolution*. Chicago: University of Chicago Press; 1996.
- [14] Poovey M. *A history of the modern fact: Problems of knowledge in the sciences of wealth and society*. Chicago: University of Chicago Press; 1998.
- [15] Hacking I. *The taming of chance*. Cambridge, UK: Cambridge University Press; 1990.
- [16] Hacking I. How should we do the history of statistics? In: Burchell G, Gordon C, Miller P, editors. *The Foucault effect: Studies in governmentality*. Chicago: University of Chicago Press; 1991. p. 181-95.
- [17] Noble DF. *The religion of technology: The divinity of man and the spirit of invention*. Harmondsworth, UK: Penguin Books; 1999.
- [18] Sorell T. *Scientism: Philosophy and the infatuation with science*. New York: Routledge; 1991.
- [19] Wallerstein I. *The uncertainties of knowledge*. Philadelphia, PA: Temple University Press; 2004.
- [20] Hunt G, Barker JC. Socio-cultural anthropology and alcohol and drug research: Towards a unified theory. *Social Sci Med* 2001; 53(2): 165-88.
- [21] Woolgar S, Lezaun J. The wrong bin bag: A turn to ontology in science and technology studies. *Social Studies Sci* 2013; 43(3): 321-40.
- [22] Hacking I. *Historical ontology*. Cambridge, MA: Harvard University Press; 2002.
- [23] Luna LE. The concept of plants as teachers among four mestizo shamans of Iquitos, northeastern Peru. *J Ethnopharmacol* 1984; 11(2): 135-56.
- [24] McKenna DJ. Ayahuasca: An ethnopharmacologic history. In: Metzner R, editor. *Ayahuasca: Hallucinogens, consciousness, and the spirit of nature*. New York: Thunder's Mouth Press; 1999, 187-213.
- [25] McKenna DJ, Towers GHN, Abbot F. Monoamine oxidase inhibitors in South American hallucinogenic plants: Tryptamine and beta-carboline constituents of ayahuasca. *J Ethnopharmacol* 1984; 10(2): 195-223.
- [26] Ott J. *Pharmacothoon: Entheogenic drugs, their plant sources and history*. 2nd Ed. Kennewick, WA: Natural Products Company; 1996.
- [27] McKenna DJ, Luna LE, Towers GN. Biodynamic constituents in ayahuasca admixture plants: An uninvestigated folk pharmacopeia. In: Schultes RE, vonReis S, editors. *Ethnobotany: Evolution of discipline*. Portland, OR: Dioscorides Press; 1995. p. 349-61.
- [28] Labate BC, Camurça DM, Brissac S, Ott J. Hoasca ethnomedicine: Traditional use of "nove vegetais" ("nine herbs") by the União do Vegetal. In: Labate BC, Jungaberle H, editors. *The internationalization of ayahuasca*. Zürich: Lit Verlag; 2011. p. 49-69.
- [29] Fotiou E. *From medicine men to day trippers: Shamanic tourism in Iquitos, Peru* [Ph.D. dissertation]. Madison, WI: University of Wisconsin-Madison; 2010.
- [30] Dubé F. Woman dies in healing ritual; shaman guilty. *National Post*. 2003 April 25.
- [31] Riba J, Barbanj MJ. Bringing ayahuasca to the clinical research laboratory. *J Psychoactive Drugs* 2005; 37(2): 219-30.
- [32] McKenna DJ. Clinical investigations of the therapeutic potential of ayahuasca: Rationale and regulatory challenges. *Pharmacol Therap* 2004; 102(2): 111-29.
- [33] Hofmann A. *LSD: My problem child*. Santa Cruz, CA: Multidisciplinary Association for Psychedelic Studies; 2009.
- [34] Dobkin de Rios M. *Visionary vine: Psychedelic healing in the Peruvian Amazon*. San Francisco, CA: Chandler Publishing Co.; 1972.
- [35] Pantoja MC, Conceição OSd. The use of ayahuasca among rubber tappers of the Upper Juruá. In: Labate BC, MacRae E, editors. *Ayahuasca, ritual and religion in Brazil*. London: Equinox; 2010. p. 21-37.
- [36] Lenaerts M. Substances, relationships and the omnipresence of the body: An overview of Ashéninka ethnomedicine (Western Amazonia). *J Ethnobiol Ethnomed* 2006; 2: 1-19.
- [37] Oram M. Efficacy and enlightenment: LSD psychotherapy and the drug amendments of 1962. *J History Medicine Allied Sci* 2012 in press.
- [38] Russo EB, McPartland JM. Cannabis is more than simply Δ^9 -tetrahydrocannabinol. *Psychopharmacol* 2003; 165(4): 431-2.
- [39] Anderson B. *Classifying ayahuasca: The role of subjective experience in psychiatric research with psychedelics* [Masters thesis]. London: London School of Economics; 2011.
- [40] Ott J. *Pharmahuasca: Human pharmacology of oral DMT plus harmine*. *J Psychoactive Drugs* 1999; 31(2): 171-7.
- [41] Latour B, Woolgar S. *Laboratory life: The construction of scientific facts*. 2nd Ed. Princeton, NJ: Princeton University Press; 1986.
- [42] International Narcotics Control Board. *Report of the International Narcotics Control Board for 2010*. New York: United Nations; 2011 Contract No.: Document Number].
- [43] Tupper KW. Psychoactive substances and the English language: "Drugs," discourses and public policy. *Contemporary Drug Problems* 2012; 39(3): 461-92.
- [44] Tupper KW, Labate BC. Plants, psychoactive substances and the International Narcotics Control Board: The control of nature and the nature of control. *Human Rights Drugs* 2012; 2(1): 17-28.
- [45] Labate BC, Bouso JC. Cura, cura, cuerpecito: Reflexiones sobre las posibilidades terapéuticas de la ayahuasca. In: Labate BC, Bouso JC, editors. *Ayahuasca y Salud*. Barcelona: La Liebre de Marzo; 2013. p. 28-45.
- [46] Sefa Dei GJ, Hall BL, Goldin RD, editors. *Indigenous knowledges in global contexts: Multiple readings of our world*. Toronto: University of Toronto Press; 2000.
- [47] Pasquarelli V. Diálogo e pensamento por imagem: Etnografia e iniciação em *Las enseñanzas de Don Juan*, de Carlos Castañeda. *Revista Brasileira de Ciências Sociais*. 1995; 29: 103-26.
- [48] Viveiros de Castro E. Cosmological deixis and Amerindian perspectivism. *J Royal Anthropological Institute* 1998; 4(3): 469-88.
- [49] Doyle RM. *Darwin's pharmacy: Sex, plants, and the evolution of the noosphere*. Seattle, WA: University of Washington Press; 2011.
- [50] Benedikt BM. *Curiosity: A cultural history of early modern inquiry*. Chicago; 2001.
- [51] Horowitz M, Palmer C, editors. *Moksha: Aldous Huxley's classic writings on psychedelics and the visionary experience*. Rochester, VT: Park Street Press; 1999.
- [52] Watts AW. *The joyous cosmology: Adventures in the chemistry of consciousness*. New York: Pantheon Books; 1962.
- [53] Leary T. *The politics of ecstasy*. Berkeley, CA: Ronin Publishing; 1998.
- [54] Grof S. *Realms of the human unconscious: Observations from LSD research*. New York: Viking Press; 1975.
- [55] Richards WA. The rebirth of research with entheogens: Lessons from the past and hypotheses for the future. *J Transpersonal Psychol* 2009; 41(2): 139-50.
- [56] Müller CP, Schumann G. Drugs as instruments: A new framework for non-addictive psychoactive drug use. *Behav Brain Sci* 2011; 34(6): 293-347.
- [57] Móró L, Noreika V. Sacramental and spiritual use of hallucinogenic drugs. *Brain Behav Sci* 2011; 34(6): 319-20.
- [58] Blainey MG. Forbidden therapies: Santo Daime, ayahuasca, and the prohibition of entheogens in western society. *J Relig Health* 2015; 54: 287-302.

- [59] Tupper KW. Entheogens and existential intelligence: The use of plant teachers as cognitive tools. *Canadian J Education* 2002; 27(4): 499-516.
- [60] Nutt DJ, King LA, Nichols DE. Effects of Schedule I drug laws on neuroscience research and treatment innovation. *Nat Rev Neurosci* 2013; 14(8): 577-85.
- [61] Ong W. Orality and literacy: The technologizing of the word. New York: Methuen; 1982.
- [62] Daston L, Park K. Wonders and the order of nature 1150-1750. New York: Zone Books; 1998.
- [63] Altman LK. Who goes first?: The story of self-experimentation in medicine. New York: Random House; 1987.
- [64] Jay M. The atmosphere of heaven: The unnatural experiments of Dr. Beddoes and his sons of genius. New Haven, CT: Yale University Press; 2009.
- [65] Snow SJ. Blessed days of anaesthesia: How anaesthetics changed the world. Oxford: Oxford University Press; 2008.
- [66] Ott J. Ayahuasca analogues: Pangæan entheogens. Kennewick, WA: Natural Products Company; 1994.
- [67] Shulgin A, Shulgin A. PIHKAL: A chemical love story. Berkley, CA: Transform Press; 1991.
- [68] Shulgin A, Shulgin A. TIHKAL: The continuation. Berkeley, CA: Transform Press; 1997.
- [69] James W. The varieties of religious experience: A study in human nature. London: Longmans, Green & Co.; 1902.
- [70] Daston L, Galison P. Objectivity. New York: Zone Books; 2007.
- [71] Shanon B. The epistemics of ayahuasca visions. *Phenomenology and the Cognitive Sciences* 2010; 9(2): 263-80.
- [72] Grof S. Interview with Stan Grof - Council of Psychedelic Elders. Kalamazoo, MI: The Fetzer Foundation; 1998.
- [73] Hanegraaff WJ. Ayahuasca groups and networks in the Netherlands: A challenge to the study of contemporary religion. In: Labate BC, Jungaberle H, editors. *The internationalization of ayahuasca*. Zürich: Lit Verlag; 2011. p. 85-103.
- [74] Winkler P, Csémy L. Self-experimentations with psychedelics among mental health professionals: LSD in the former Czechoslovakia. *J Psychoactive Drugs* 2014; 46(1): 11-9.
- [75] Doyle R. Healing with plant intelligence: A report from ayahuasca. *Anthropol Consciousness* 2012; 23(1): 28-43.
- [76] Pearson H. Science and the war on drugs: A hard habit to break. *Nature* 2004; 430(6998): 394-5.
- [77] Norcross JC, Koocher GP, Fala NC, Wexler HK. What does not work? Expert consensus on discredited treatments in the addictions. *J Addiction Med* 2010; 4(3): 174-80.
- [78] Thomas G, Lucas P, Capler NR, Tupper KW, Martin G. Ayahuasca-assisted therapy for addiction: Results from a preliminary observational study in Canada. *Curr Drug Abuse Rev* 2013; 6(1): 30-42.
- [79] Narby J. Ayahuasca rollercoaster. *Breaking Convention*; 2013 July 14; University of Greenwich. 2013.
- [80] Ayahuasca Treatment Outcome Project. Ayahuasca Treatment Outcome Project. [cited 2014 January 22]; Available from: <http://www.indiegogo.com/projects/ayahuasca-treatment-outcome-project>.
- [81] Labate BC, Feeney K. Ayahuasca and the process of regulation in Brazil and internationally: Implications and challenges. *Int J Drug Policy* 2012; 23(2): 154-61.